Preliminary Photochemical Air Quality Modeling for CCOS

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Overview of Presentation

- Experimental Design Plan
- Status of Operations
- Forecasting and Decision-Making
- Preliminary Modeling

Previous Experience

- SARMAP field program in 1990
- SARMAP Modeling System in early 90's
  - Emissions Model (EMS-95)
  - Meteorological Model (MM5)
  - SARMAP Air Quality Model (SAQM)
- SJV Ozone SIP in 1994

Recent Improvements

- Emissions (EMS-95)
  - MV - EMFAC 2000
  - Area - Agricultural IC engines etc.
  - Biogenics - new estimates
  - Point - None
- Meteorology (MM5)
  - Code improvements by PSU and MCNC
  - In-house simulation (episodic, operational)

Recent Improvements

- Air Quality (SAQM)
  - Validation of chemistry code
  - New chemical mechanism and numerical solver (SAPRC-97 with Gear-type solver)
  - Parallel computations
- Personnel
  - Addition of staff with experience in air quality modeling and meteorology

New Modeling Tools

- Air Quality Simulation
  - Models-3/CMAQ
  - MAQSIP
  - SAQM with improvements
- Visualization
  - Vis5D
  - PAVE

Computer Improvements

- Old Paradigm
  - Expensive high-end computers
  - SARMAP computers are now obsolete
- New Paradigm
  - Inexpensive and powerful PCs
  - multi-processor - parallel computing
  - Operating systems: Unix, Linux, NT

Run-Time Improvements

System	Then	Now
Emissions	Days	Hours
Meteorology	Weeks	Days
Air Quality	Days	Hours

CCOS June 2000 Episode

Station	O_3 1-Hr Maximum (ppb)			
	13th	14th	15th	16th
Arvin	98	140	107	111
Edison	103	122	110	97
Fresno	114	119	114	92
Livermore	58	64	152	87
Parlier	100	137	142	102
Sloughouse	53	65	102	88

CCOS June 2000 Episode

- SJV: High 1-hr maxima on 14th and 15th
- Bay Area - Maximum on 15th at New Livermore Site
- Strong northerly surface winds in the Central Valley. Out flow in the Bay Area. Relatively stagnant conditions in southern SJV
- High temperatures throughout with mild cooling as episode progressed

Preliminary Modeling of CCOS June 2000 Episode

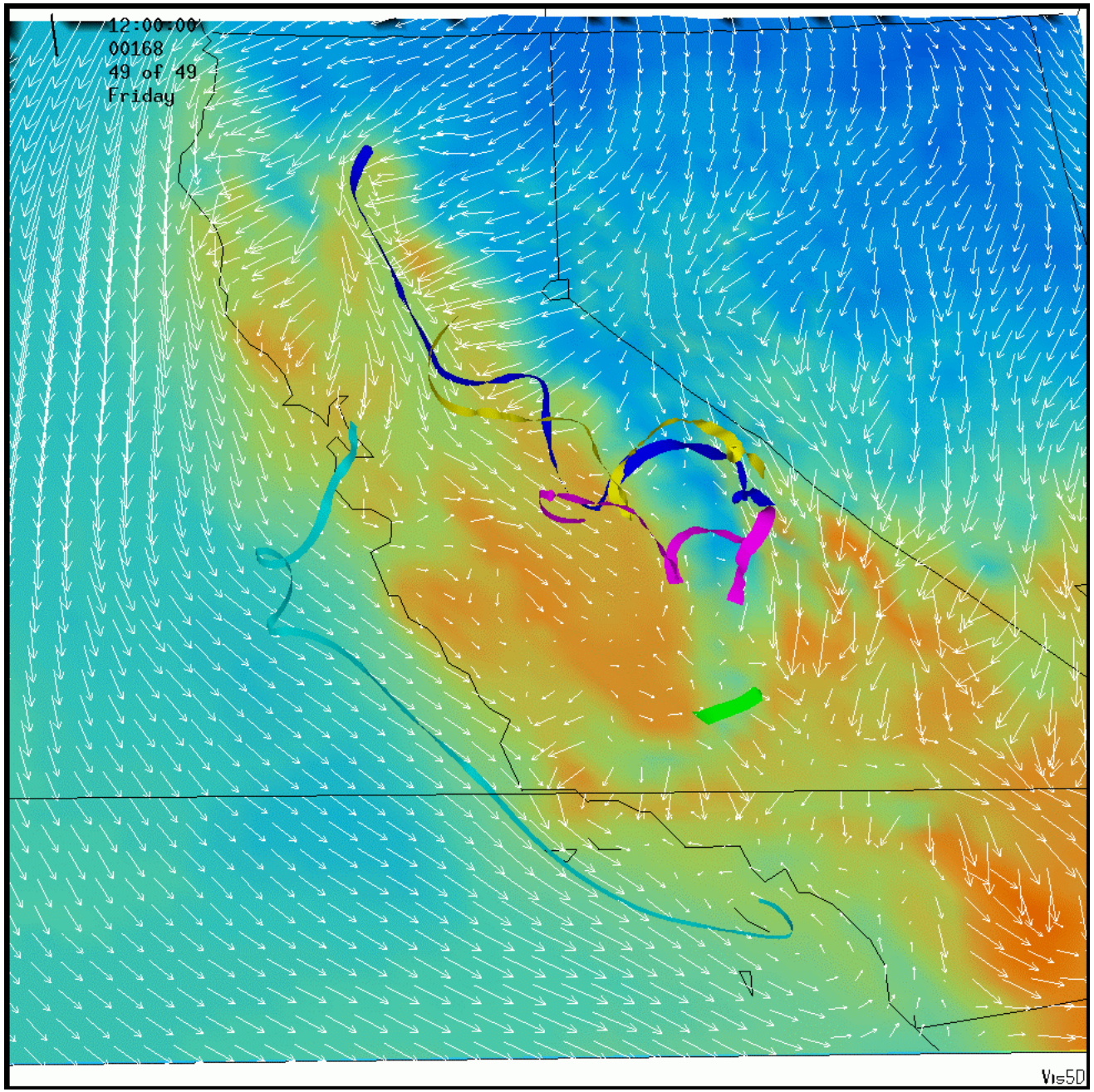
- Domain (Identical to that of SARMAP)
  - 12 km^2 grid size
  - 15 vertical levels
- Time Period
  - 5 am (12Z) June 14^{th} to 5 am (12Z) June 16^{th}
  - Two days of spin-up

Preliminary Modeling of CCOS June 2000 Episode

- Emissions (EMS-95)
  - Typical week day (1999 Monday)
  - EMFAC-2000 for MV
  - Agricultural IC engines for Area
  - Old biogenics and point emissions
- Meteorology (MM5)
  - 12-km non-FDDA
  - Run in-house

Preliminary Modeling of CCOS June 2000 Episode

- Air Quality (Models-3/CMAQ)
  - Carbon Bond IV chemistry
  - Gear-type chemistry solver
  - SARMAP-1999 Initial/Boundary conditions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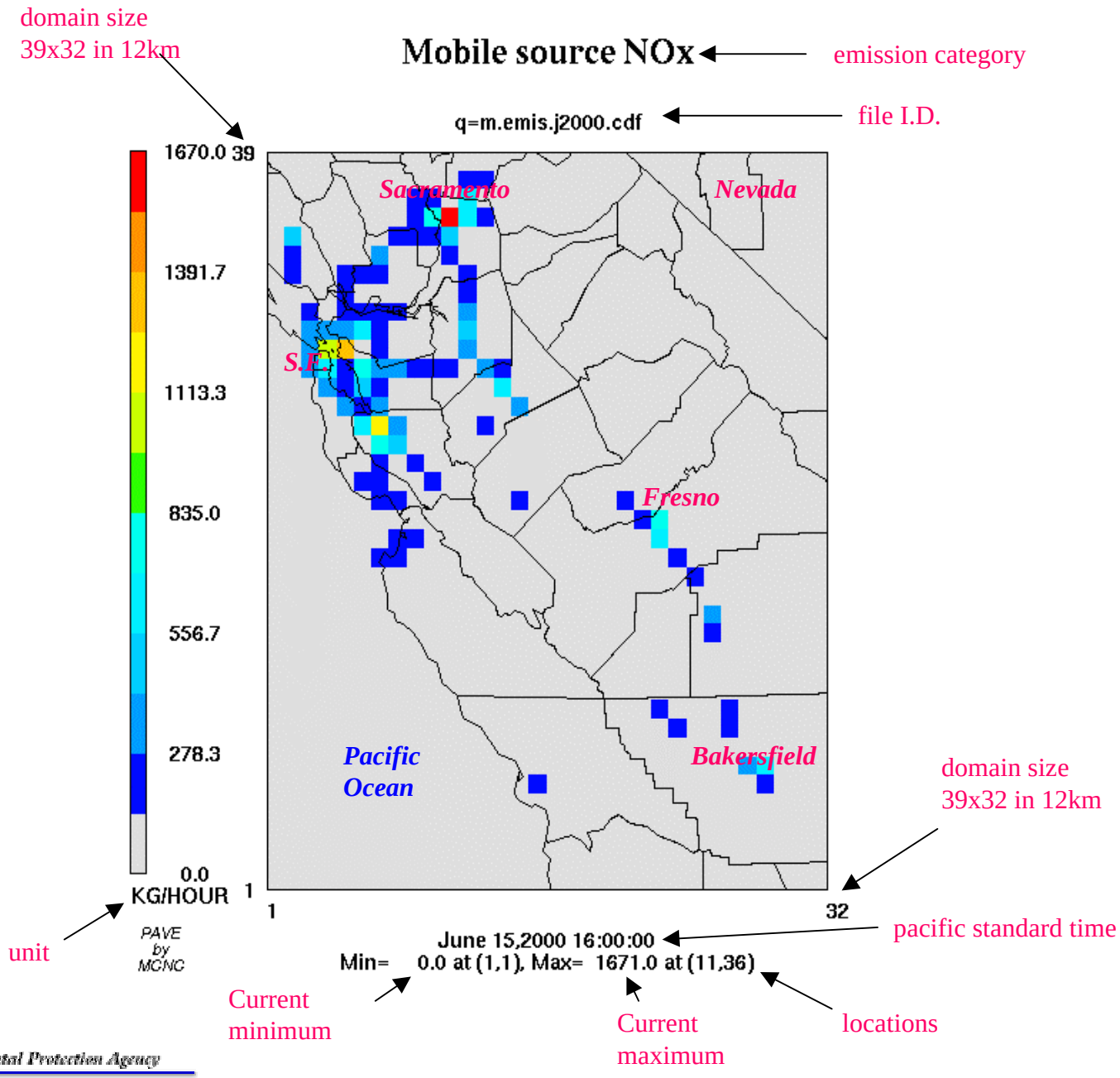
VIS5D



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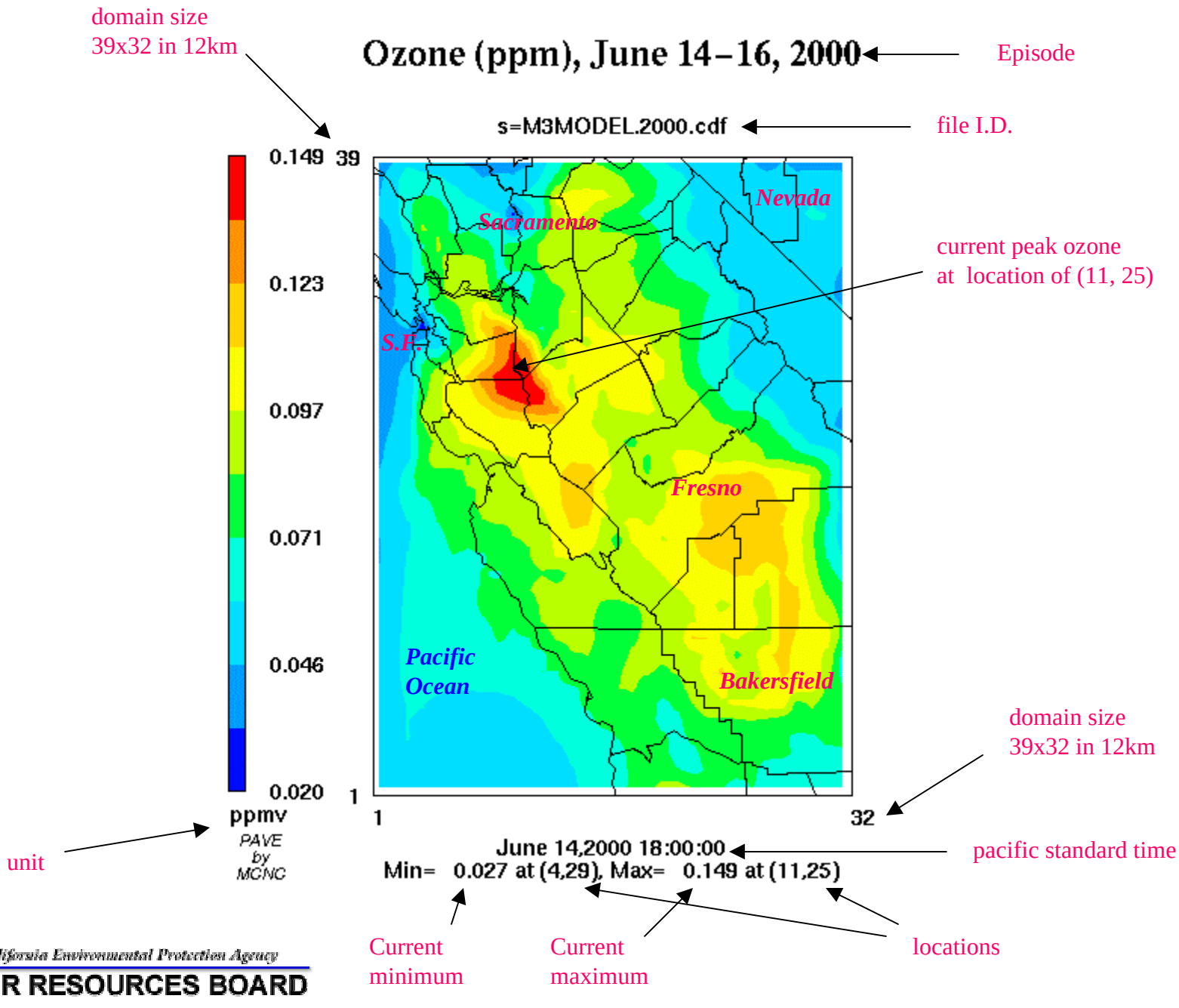

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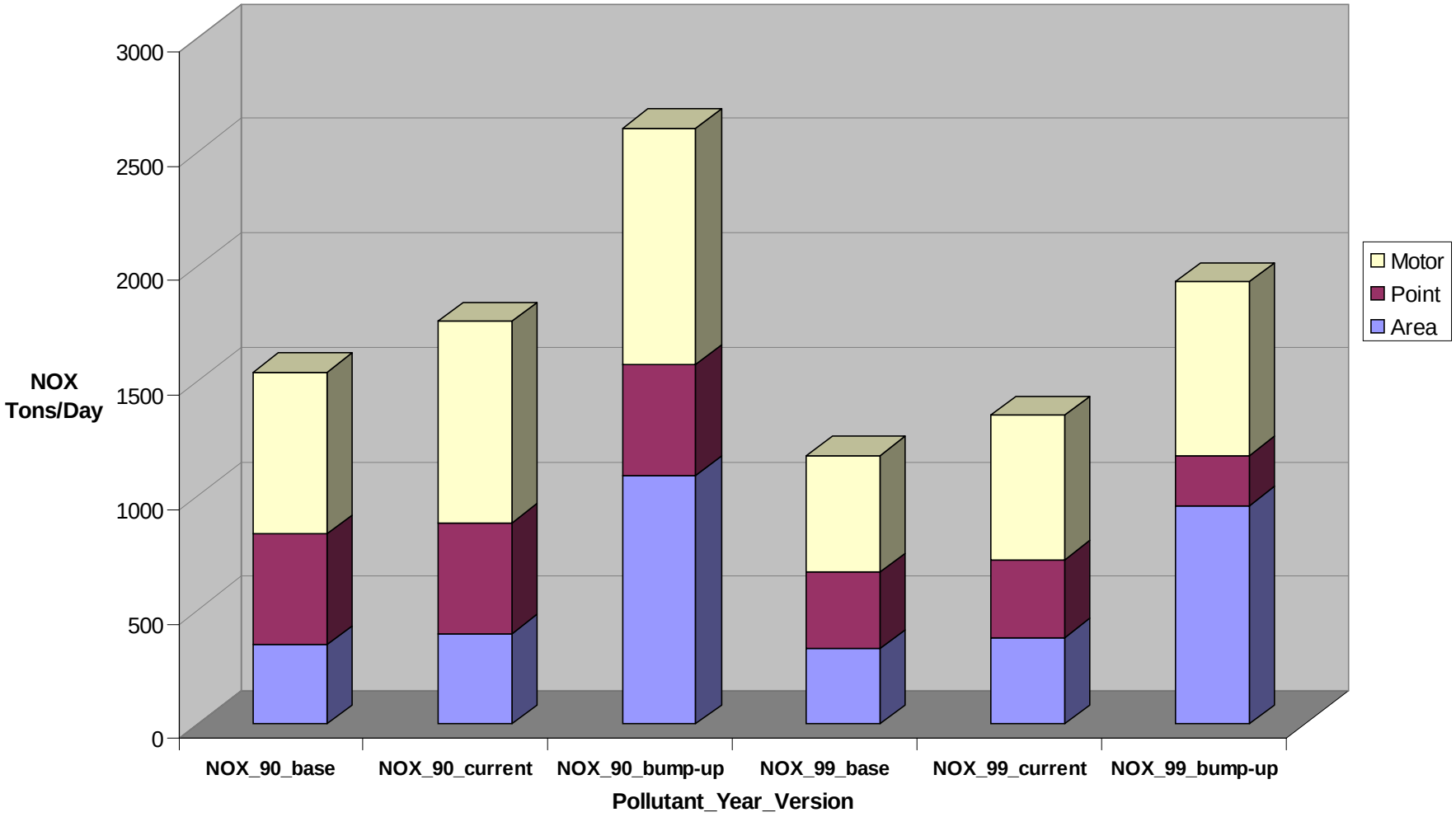
Summary of Preliminary Modeling Results

- High O_3 predicted in Bay Area and SJV
- Sharp gradients in Bay Area peak not reproduced
- SJV peaks on the 14th for most stations not reproduced, however overall magnitudes of concentrations are in agreement
- Due to the unique meteorological conditions during build up, spin-up should be longer

Future Modeling

- Emissions (EMS-95)
  - Off-road area sources
  - New biogenics
  - New temporal and spatial profiles for MV
  - Point sources
- Meteorology (MM5)
  - FDDA simulation
  - Model performance for multiple episodes

SARMAP Domain NOX Emissions Comparison (Monday, August 6th or Average Day)
Base-SIP, Current, and Estimated SIP Bump-Up Emissions for SARMAP Domain



Future Modeling

- Air Quality
  - Alternative models (SAQM, MAQSIP, Models-3/CMAQS)
  - Utilize aircraft measurements for boundary conditions
  - New chemical mechanisms and solvers
  - Model performance for multiple episodes

Modeling Schedule

- Complete preliminary modeling of five CCOS episodes - Winter 2000
- Acquire quality-assured data from field study - Spring 2001
- Start refined modeling - Spring 2001
- SIP planning simulations - Summer 2001

Resource Needs

- CCOS 12 km^2 domain covers entire California (1994 SIP - Central California)
- Finer resolution of CCOS domain (4 km^2) to simulate detailed flow features
- Computational burden is expected to be an order of magnitude larger

Resource Needs

- Further assessment of cost-effective parallel and cluster computer environments desired
- Incremental addition of computer resources proposed

Summary

- We have built upon 1994 SIP modeling experience
- Significant improvements in emissions, models, computers, and personnel
- Preliminary modeling results of June 14-15, 2000 CCOS episode are encouraging
- Additional computer resources needed for proposed work elements